



Environmental Energy Technologies Division Lawrence Berkeley National Laboratory

IES Group Overview

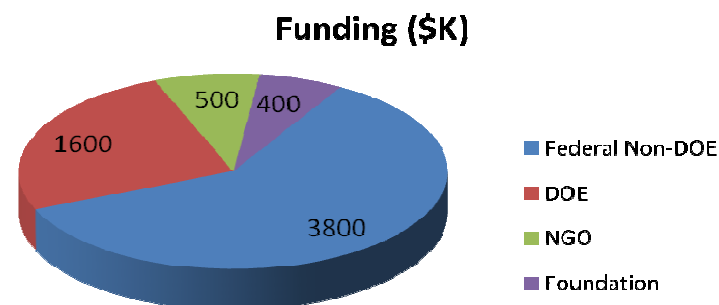
30 July 2013

International Energy Studies Group Overview



- Established: **1978** -- Founder: **Jayant Sathaye**
- Group Leader (Acting): **Charles Goldman**
- Deputy Group Leaders: **Michael McNeil & Amol Phadke**
- Number of Staff: **21 (+ 2 student assistants)**
- Number of Visiting Researchers: **2**
- Group Website: <http://ies.lbl.gov/>
- Primary Supporters: US DOE, EPA, AID and State, California Energy Comm. and ClimateWorks Foundation
- Current Funding: **\$6.25 Million***

* Including subcontracts



International Energy Studies Group Staff and Visitors



- Charles Goldman, Staff Scientist, Department Head and Group Leader (Acting)
- Dr. Amol Phadke, Principal Scientific Engineering Associate and Deputy Group Leader (Acting)
- Dr. Michael McNeil, Program Manager III and Deputy Group Leader (Acting)
- Dr. Jayant Sathaye, Senior Scientist and former Group Leader (Retired Rehired)
- Dr. Edward Vine, Staff Scientist
- Dr. Tengfang Xu, Research Scientist
- Stephane de la Rue du Can, Program Manager II
- Dr. Anand Gopal, Senior Scientific/Engineer Associate
- Dr. Nikit Abhyankar, Sr Scientific/Engineer Associate
- Virginie Letschert, Principal Research Associate
- Alissa Johnson, Senior Research Associate
- Won Young Park, Senior Research Associate
- Dr. Nihar Shah, Scientific Engineer Associate
- Nicholas Bojda, Research Associate
- Mo Zhou, Research Associate
- Jasmine Harris, Administrative Assistant III
- Dr. Samveg Saxena, Guest Scientist
- Dr. Nihan Karali, Postdoctoral Fellow
- Ranjit Deshmukh, UC GSRA
- Ujala Shanker, GSRA
- Gayatri Gadag, GSRA
- Puneeth Kalavase, Guest
- Chae Yean Lee, Guest
- Greg Leventis, Guest
- Simone Souza, Guest

The IES group

- **Makes an Impact** through rigorous analysis of the policy, economic, and technical issues that are most relevant to transitioning to a clean, efficient, reliable, and affordable energy system.
- **Provides Insights** to developing country decision makers based on objective analysis of the policy landscape, taking into account international best practices and particularity of local markets and policy regimes.
- **Transfers Methodologies** developed to address U.S. energy policy analysis questions to a global audience.
- **Provides a Bridge** between expertise held by colleagues at LBNL and beyond to developing country stakeholders.
- **Facilitates Exchange** of ideas and builds capacity through training and hosting of foreign researchers.

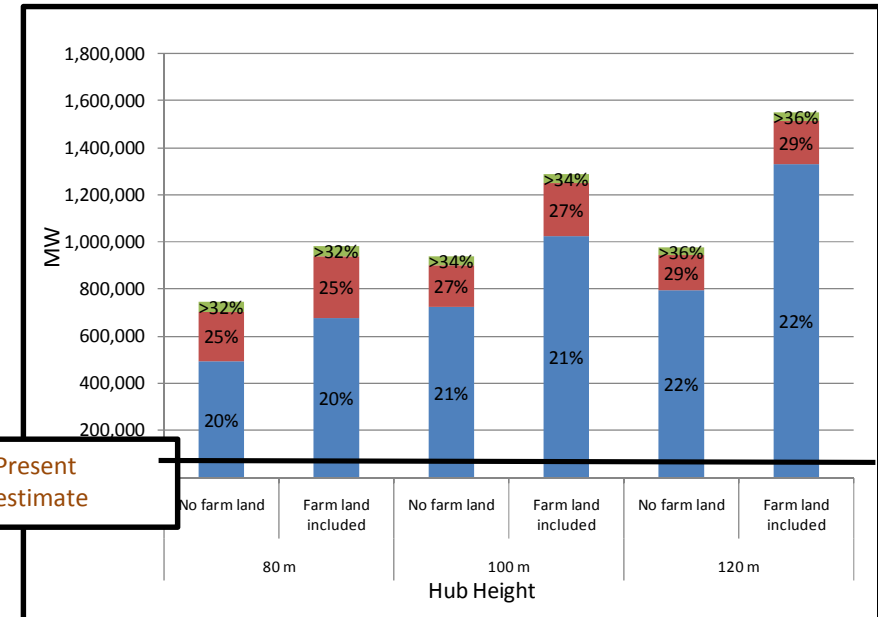
IES Current Focus Areas



- Appliance efficiency techno-economic and policy/program assessment in several countries
 - International Appliance Efficiency Modeling (BUENAS)
 - Super Efficient Appliance Deployment Initiative (SEAD)
 - Policy Analysis Modeling System for Minimum Energy Performance Standards (PAMS-MEPS)
- Buildings Sector Efficiency
 - Buildings Energy Efficiency Across Countries
 - Integrated Simulation and Techno-economic assessments tool for residential buildings
 - Building Energy Standards
- Evaluation Measurement & Verification
 - Planning, Managing and Conducting Evaluations of Energy Efficiency Programs in the U.S. and Internationally
 - Developing Evaluation Training Materials on Impact, Process and Market Assessment Evaluations
- Industrial sector energy efficiency
 - Industrial Sector Energy Efficiency Benchmarking and Evaluations
 - Techno-Economic Assessments Across Manufacturing Sectors
 - International Industrial Sector Energy Efficiency Modeling (ISEEM)
- Off-Grid and mini-grid techno-economic and policy assessment in India and Africa
 - Off-Grid and Mini-Grid Techno-Economic and Policy Assessment in India and Africa
 - Global LEAP Program Support
- Clean energy options and policy assessment in the Indian power sector
 - Renewable Energy Potential Estimation and Integration Assessment
 - Energy Efficiency Techno-Economic Assessments and Policy and Program Design (appliances, buildings, and industries)
 - Cross Sectoral Assessments (e.g., Technical Feasibility and Economic Desirability of Electrification of Transport)
- Transportation
 - Real-World Performance of Alternative Vehicle Technologies in Emerging Economies
 - MoSTrans Sensor Development

India power sector: renewable energy (RE) potential estimation and integration assessment

- Scope of RE Studies
 - Evaluate the techno-economic potential renewable energy options in India
 - Evaluate cost-benefit and technical feasibility of clean energy scenarios in India including issues related to RE integration
 - Assess policies, programs, regulation for adoption of clean energy and provide technical support on the same
- Wind Energy Potential
 - LBNL study shows wind potential in India is > 20 times the previous official estimate
 - Significant recognition of findings among Indian government energy agencies, policymakers and sponsors (Climate Works)
 - Results referenced by key state regulations and transmission studies
 - Several new opportunities to collaborate with key Indian government agencies on power sector analysis

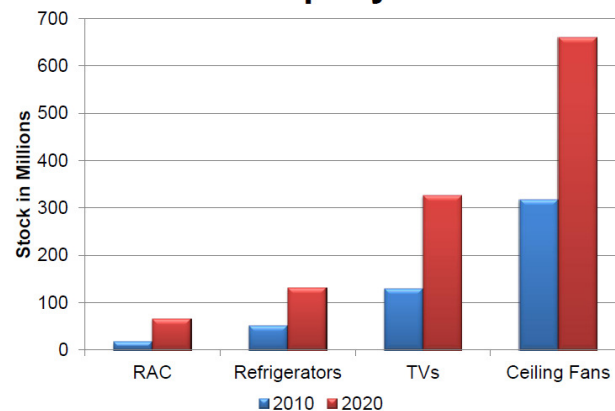


India Power Sector: Energy Efficiency Support



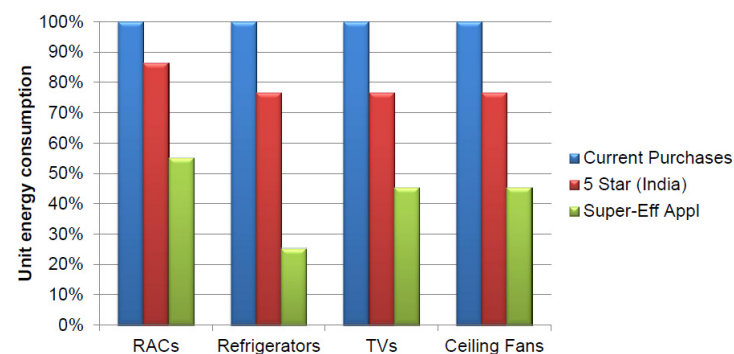
- With Prayas Energy Group, co-led the conceptualization, design and implementation of the first national level upstream incentive program for appliances in India – Super Efficient Equipment Program (SEEP)
 - Government of India in process of implementing SEEP with \$40 million funding from World Bank
- Contributed significantly to the development of the first DSM regulations in India for the state of Maharashtra
 - Technical assistance to several other states and to national level guidance on DSM regulations issued by Forum of Regulators.

Ownership of Appliances in India Growing Rapidly



By 2020, more than 70% of the stock of appliances will have been added just after 2010. Urgent need to improve efficiency to avoid being stuck with inefficient stock

Comparison of Consumption of Current Purchases and Highest Rated in India with Best World-Wide

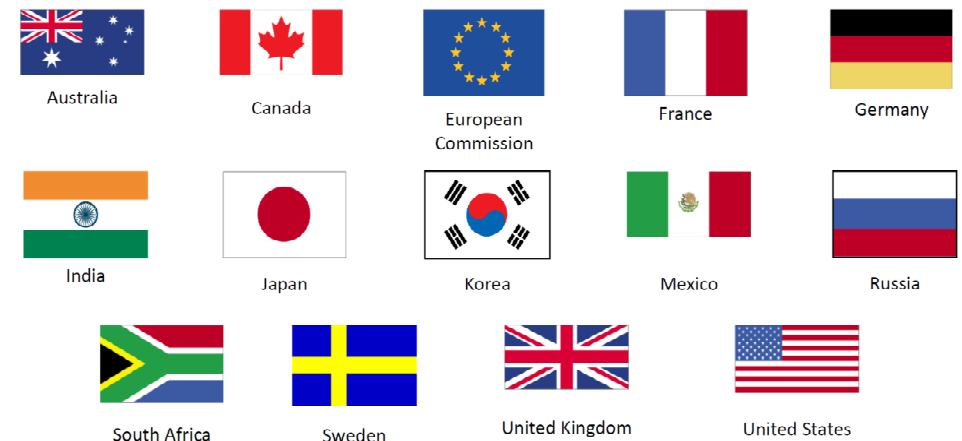


Large gap between average current purchase and highest rated model (5-Star), and even larger gap between highest rated and best commercially available world-wide.

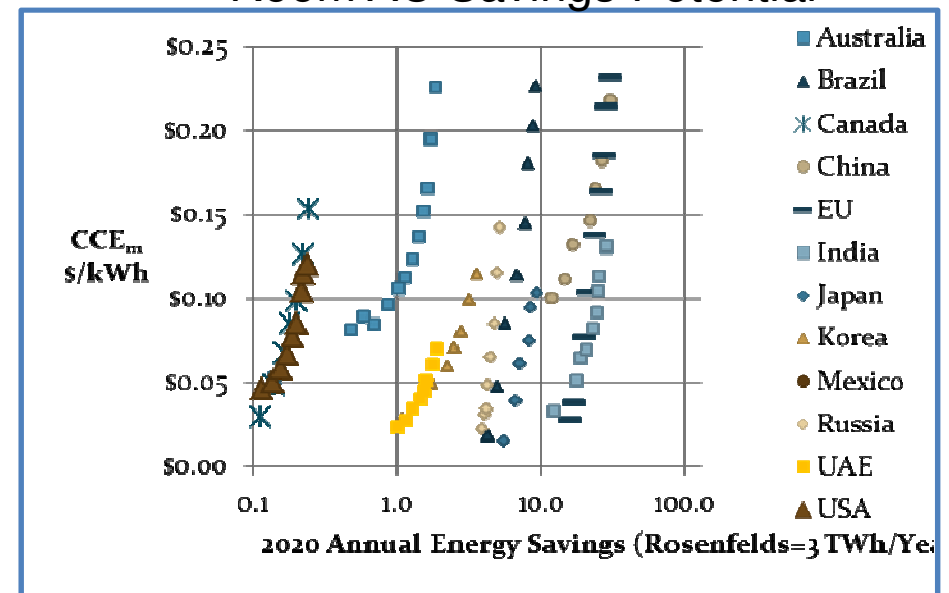
Super Efficient Appliance Deployment Initiative (SEAD)



- Since program inception in 2010, LBNL is main provider of technical support to appliance efficiency working groups covering
 - Standards and Labeling
 - Financial Incentives
 - Awards
 - Procurement
- Technical reports detailing techno-economic efficiency potential for :
 - Televisions
 - Split-system Room Air Conditioners
 - PC Monitors
 - Ceiling Fans
 - Refrigerators
- Bi-lateral Technical Support for South Africa, India, Mexico
- World Bank financing incentive program in India for superefficient appliances



Room AC Savings Potential

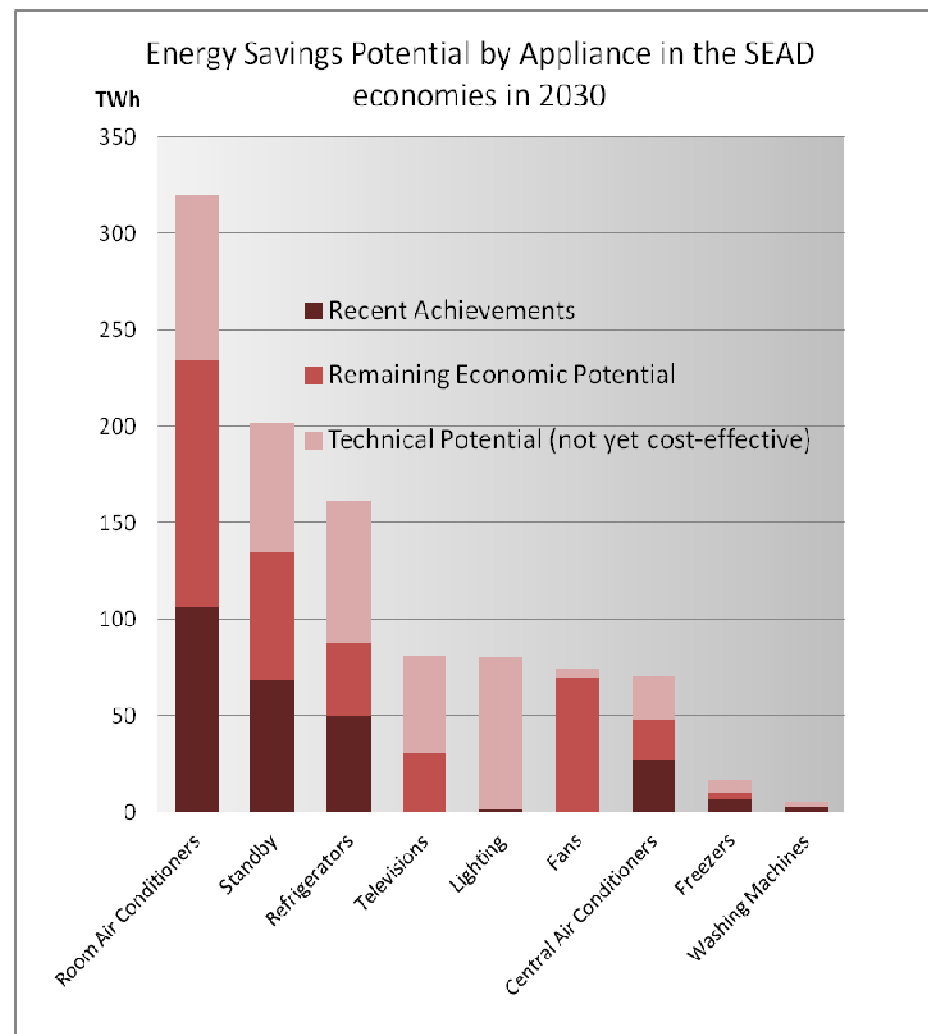


CCE = Cost of Conserved Electricity

Appliance Efficiency Modeling – Bottom-Up Energy Analysis System (BUENAS)



- Purpose and Scope
 - Global projection of appliance energy demand and greenhouse gas emissions through 2030
 - By Country - Currently covers 13 major economies that account for ~80% of global energy demand
 - Covers 15 building and industrial appliances and equipment ~200 equipment / country combinations
- Policy Scenarios
 - Best Practices – Identifies ‘achievable’ efficiency targets based on alignment of MEPS across regions to model *harmonization potential*
 - Cost-Effective Potential – Integrates BUENAS and Global Energy Efficiency Cost (GEEC) Database developed at LBNL to model *economic potential*
 - Best-Available Technology – Most Aggressive scenario represents *technical potential*
- Recent Applications
 - Analytical Framework for Super-Efficient Appliance Deployment (DOE/Clean Energy Ministerial Initiative)
 - Input to IEA *World Energy Outlook 2012*
 - Featured in IIASA Global Energy Assessment, IPCC 5th Assessment



Source: Letschert et al. 2013
Includes Australia, Brazil, Canada, China, EU, India, Indonesia, Japan, Korea, Mexico, Russia, South Africa, USA

S&L Program Implementation Technical Assistance – Policy Analysis Modeling System for Minimum Energy Performance Standards (PAMS-MEPS)



Purpose and Scope

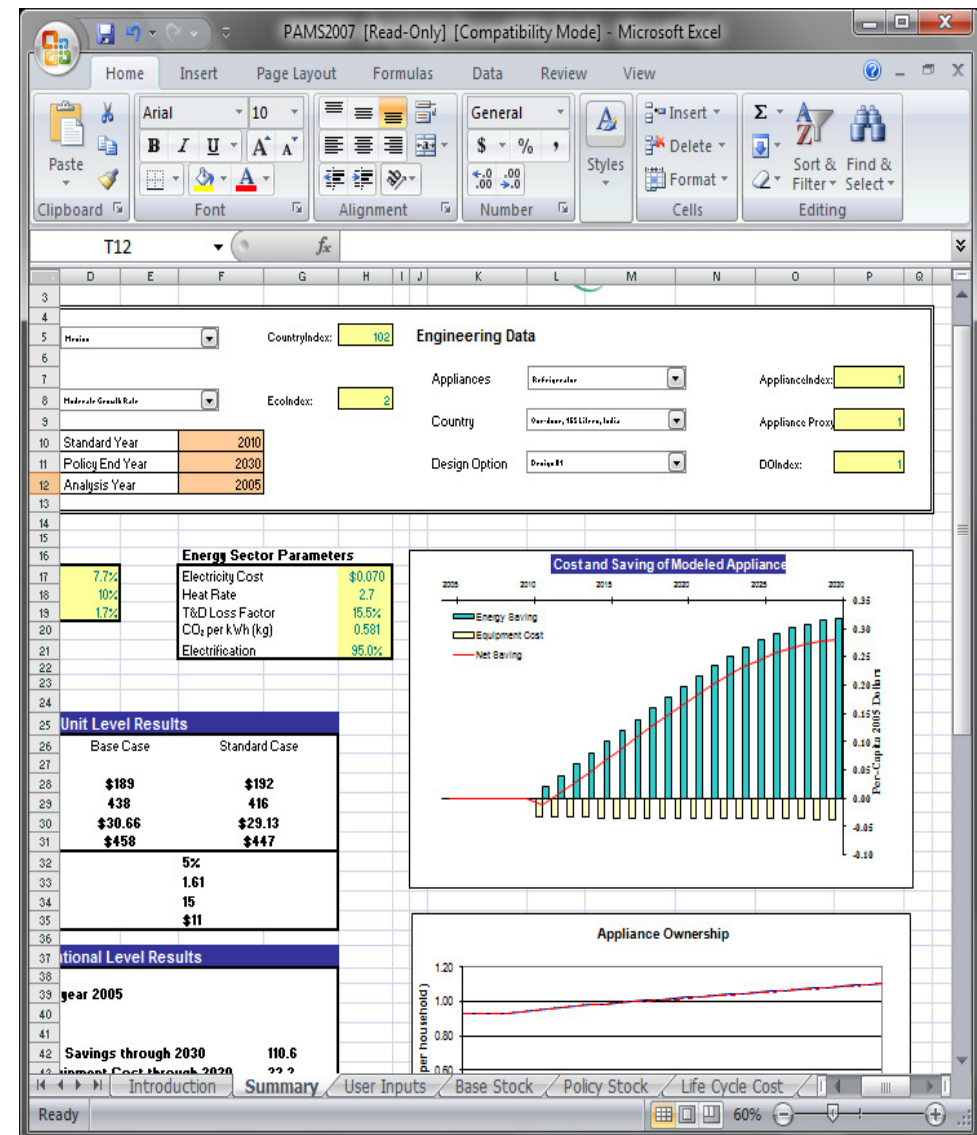
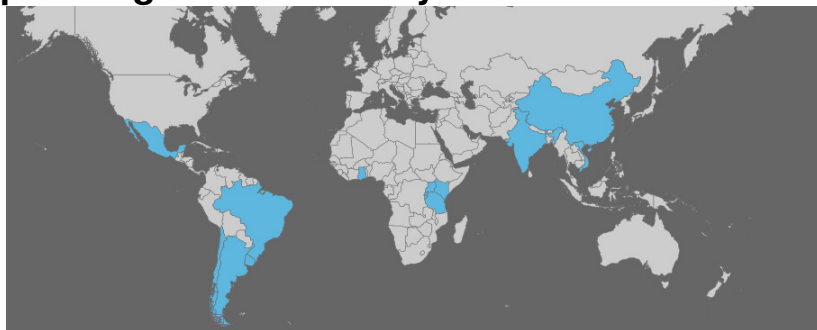
- Transfer of U.S. DOE standard-setting methodologies to countries with limited resources
- Deployment of PAMS-MEPS, a tool that provides techno-economic analysis and national impact analysis for different efficiency levels
 - Built-in default values for 150 countries and 3 appliances (room AC, refrigerator, washing machine)
 - Based on data availability, easy customization through user-friendly interface

Main Projects Outputs

- Study supports energy efficiency program implementation with evaluation of main impacts on consumers and at the national level
- Enhancement of local staff capacity in program implementation

Sponsors : CLASP, DOE, ICA, NREL/USAID

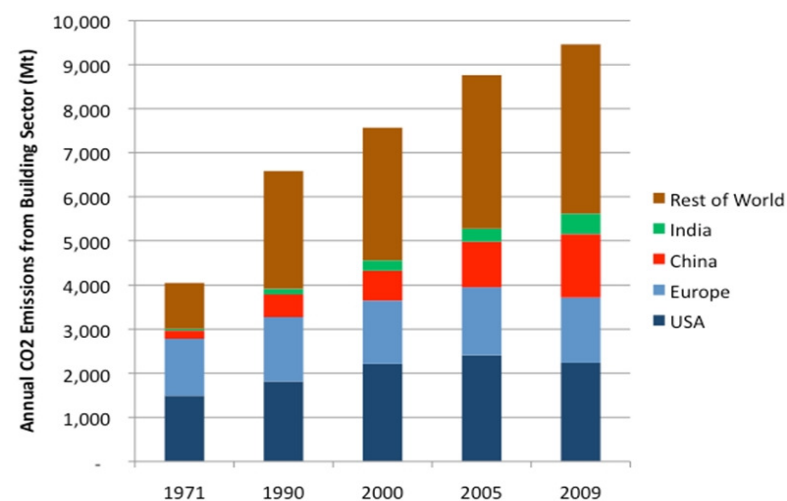
Upcoming/Recent country collaboration:



Building Energy Efficiency

- Building energy policy and technology expertise in global contexts including experience in major economies (e.g., U.S., India and China)
 - Building standard/code studies in U.S. and emerging economies.
 - Building technology deployment and system evaluations.
- International techno-economic assessments in major economies
 - cost-curves for diverse technologies, climates, and building types.
 - integrated framework using building simulation tools and field validations.
 - support for the IPCC Assessment Report (AR5).

Annual CO₂ Emissions from Building Sector

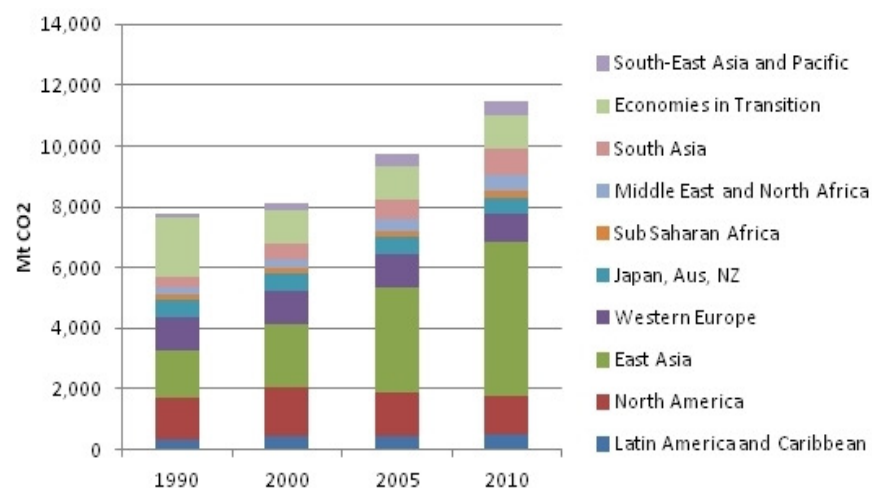


Levine et al (2012). Building Energy-Efficiency Best Practice Policies and Policy Packages. LBNL 6006E

Industrial Energy Efficiency

- International policy and techno-economic assessments across sectors, including U.S., India and China
 - Global cross-sectoral energy and emerging technologies.
 - Bottom-up cost curve development for cement, steel, pulp & paper, refineries, etc.
 - ISEEM model for GHG reduction analysis
 - Incorporates data on bottom-up cost curves for selected sectors
 - Includes trade flow implications of production and energy efficiency measures
 - Projects costs of production and carbon reductions

Industrial CO₂ Emissions Trends Across the World



Program and Policy Evaluation

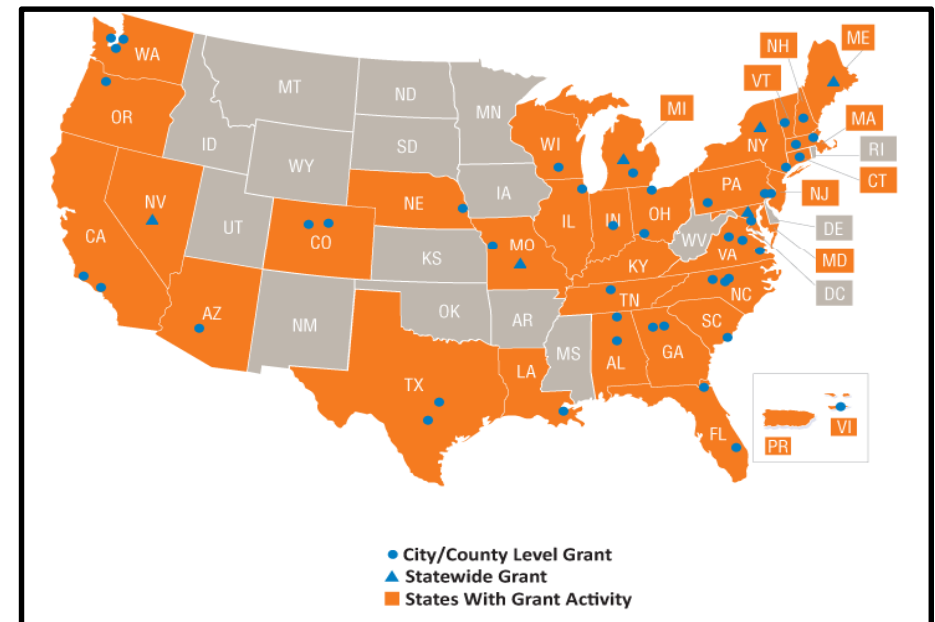
Purpose

- To promote and advance the evaluation of energy efficiency and clean energy policies and programs in the U.S. and internationally

Recent Applications

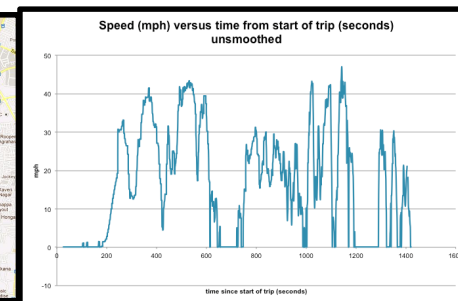
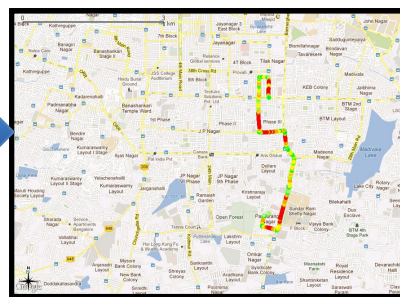
- In partnership with the International Energy Program Evaluation Conference, held the first 2 evaluation conferences outside the U.S.
 - Paris (2010) and Rome (2012)
- Managing four evaluations for U.S. Department of Energy
 - Better Buildings Neighborhood Program
 - Fuel Cells Initiative
 - Wind Powering America
 - Battery Storage
- Provided technical assistance to the California Public Utilities Commission on evaluation issues related to market effects, behavioral change programs and other energy efficiency programs
- Created journal articles on emerging evaluation issues - published in *Energy Efficiency*

Better Buildings Neighborhood Program



Transportation: Powertrain Simulation and Battery Research

IES Led: MoSTrans derived Real-world Driving Data and Behavior

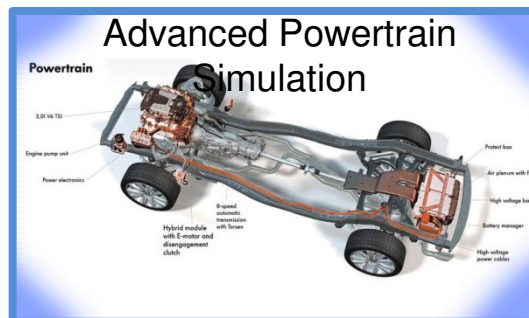


Advanced Powertrain Simulation, Economic, Environmental and Policy Analysis

Environmental
Impacts Analysis



Advanced Powertrain
Simulation



India Auto Market and Policy
Analysis



IES is working with
SES and the ESDR
department to
design batteries for
transport in India

LBNL Battery Research



Transportation: Low-Cost Sensing and Transport Electrification



MoSTrans

- IES along with startup, StreetLight Data, is developing MoSTrans – a smart phone based sensing platform for high fidelity transportation data at very low cost
- This work was chosen by Division Directors as one of just 6 research activities from across the lab to be presented to Secretary Chu

Transport Electrification

- IES Transport Electrification proposal included in 6 research concepts identified at Leadership Retreat
- Joint project with ICCT to assess the overall costs and benefits of electric vehicles in India –leverages the work of two of ClimateWorks' Best Practice Networks
- Journal articles to assess real-world performance benefits of hybrid electric cars in India and China.
 - 2 submitted +1 in preparation

- With Schatz Energy Research Center, developed technical specification including test methods and quality standards for off-grid lighting.
 - Technical specification (TS-62257-9-5) approved by IEC in 2012
 - Developing terms of reference for independent certification body for off-grid lighting QA
- Providing key inputs to Clean Energy Ministerial 4 on mini-grid roundtable in 2013
 - Regulatory and policy framework for mini-grid development
 - Grid interconnection and island operation of mini-grids
 - Demand-side load management strategies and super efficient appliances for mini-grids



Climate Change (CC)

- Energy and Forestry Sector Mitigation
 - Initiated CC Mitigation in a US assessment in 1987, and set up two mitigation working groups, one each in energy and forestry sector in a dozen countries
 - DOE, EPA and AID, and international countries supported IES to set up energy and forestry mitigation training in 35 countries in 1990s
 - Current work is focused on approaches to reduce India energy sector emissions, and identify approaches in India and China to facilitate US emissions reductions
- Global and California Modeling
 - Developed since 1990s energy and forestry country-specific and global models, e.g., COMAP and GCOMAP that are still being used in many developing countries
 - Recent work focused on evaluation of climate change impact on California power sector
- IPCC Participation
 - IES group has strong participation in IPCC since 1990s.
 - Staff acted as Coordinating Lead Authors in dozen reports

